

Appendix E: Hydrology, Geometry, and Meteorological Input Data for SSTEMP

Rio Chama at NMGF of HWY 84 -- from 1998 geomorph survey

W	Q	LN(W)	LN(Q)	Predicted LN(W)
35.3	58.61	3.5639	4.0709	3.5539
40.18	82.36	3.6934	4.4111	3.6659
42.59	115.82	3.7516	4.7520	3.7783
45.54	153.85	3.8186	5.0360	3.8718
49.77	193.45	3.9074	5.2650	3.9473
59.48	227.09	4.0856	5.4253	4.0001
60.55	295.63	4.1035	5.6891	4.0870
61.19	340.63	4.1140	5.8308	4.1337

Date : 05/13/2002

SUMMARY OUTPUT

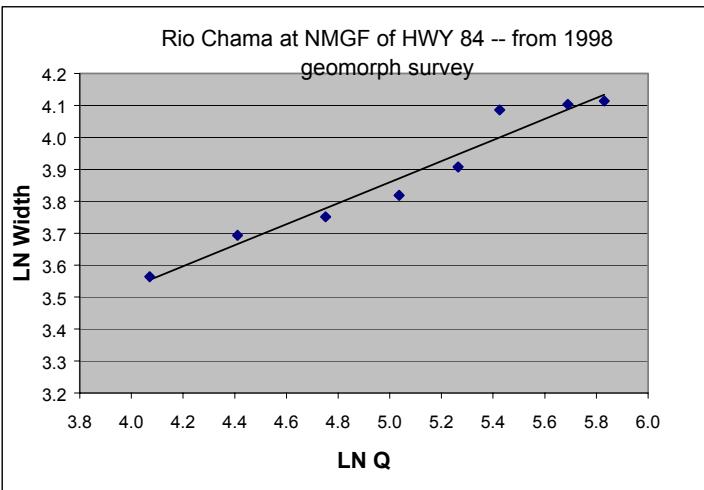
<i>Regression Statistics</i>	
Multiple R	0.976669215
R Square	0.953882755
Adjusted R Square	0.946196548
Standard Error	0.048238136
Observations	8

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.28877788	0.288778	124.10318	3.11959E-05
Residual	6	0.013961506	0.002327		
Total	7	0.302739386			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2.212585945	0.150621813	14.68968	6.251E-06	1.844027376	2.581144515
X Variable 1	0.329475914	0.029575509	11.14016	3.12E-05	0.257107198	0.40184463

B term = X variable = 0.329475914
A term = e^ intercept = 9.139319643



Chavez Creek at HWY 512 -- from 2002 survey data

W	Q	LN(W)	LN(Q)	Predicted LN(W)	**
18.48	2.15	2.9167	0.7655	2.9044	
20.69	4.75	3.0297	1.5581	3.0347	
22.36	9.31	3.1073	2.2311	3.1453	
27.56	20.92	3.3164	3.0407	3.2784	
29.69	40.46	3.3908	3.7003	3.3868	
31.59	66.11	3.4528	4.1913	3.4675	
34.4	96.63	3.5381	4.5709	3.5299	
35.55	127.6	3.5709	4.8489	3.5756	

Date : 10/30/2002

SUMMARY OUTPUT

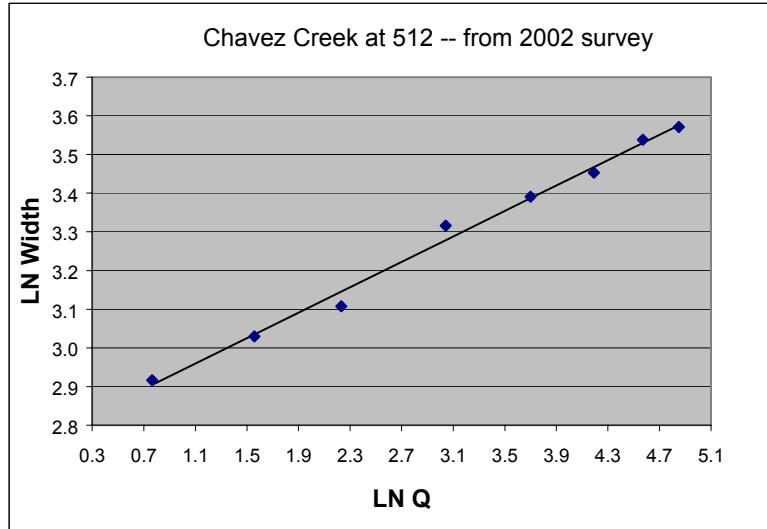
<u>Regression Statistics</u>	
Multiple R	0.99594626
R Square	0.99190896
Adjusted R Square	0.99056045
Standard Error	0.02375224
Observations	8

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.414980312	0.41498	735.5606	1.6603E-07
Residual	6	0.003385013	0.000564		
Total	7	0.418365325			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2.77855783	0.020654014	134.5287	1.14E-11	2.728019238	2.829096
X Variable 1	0.16437915	0.006060905	27.12122	1.66E-07	0.149548638	0.17921

B term = X variable = 0.16437915
A term = e^ intercept = 16.09579127



Rio Brazos at RD 573 -- from Moody survey and WINXSPRO

W	Q	LN(W)	LN(Q)	Predicted LN(W)
14.45	1.48	2.6707	0.3920	2.6069
19.87	10.4	2.9892	2.3418	3.0915
25.29	33.14	3.2304	3.5007	3.3795
34.83	48.05	3.5505	3.8722	3.4719
40.33	87.33	3.6971	4.4697	3.6204
44.88	131.58	3.8040	4.8796	3.7223
48.21	230.29	3.8756	5.4393	3.8614
52.23	434.63	3.9557	6.0745	4.0193

Date : 10/30/2002

SUMMARY OUTPUT

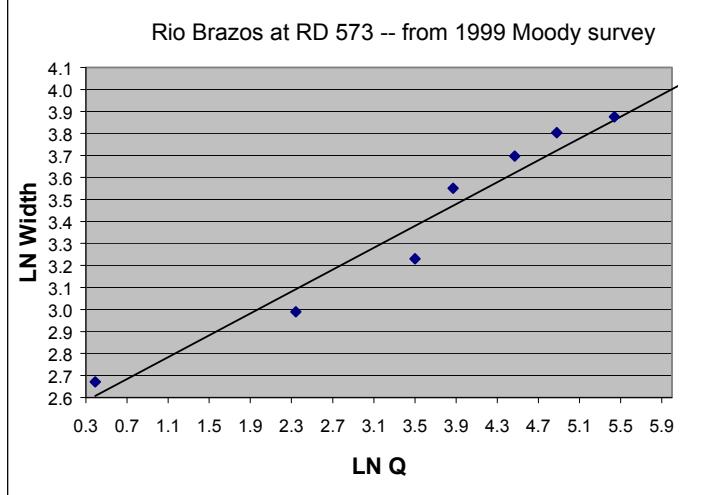
<i>Regression Statistics</i>	
Multiple R	0.979840766
R Square	0.960087926
Adjusted R Square	0.953435914
Standard Error	0.099802651
Observations	8

ANOVA

	df	SS	MS	F	Significance F
Regression	1	1.437613416	1.437613	144.33045	2.01731E-05
Residual	6	0.059763414	0.009961		
Total	7	1.49737683			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2.509409098	0.087522025	28.67174	1.192E-07	2.295250262	2.723567935
X Variable 1	0.248557912	0.020689434	12.01376	2.017E-05	0.197932654	0.29918317

B term = X variable = 0.248557912
A term = e^ intercept = 12.29766121



Rito de Tierra Amarilla at 112 -- from 2002 survey and WINXSPRO

W	Q	LN(W)	LN(Q)	Predicted LN(W)
10.65	2.02	2.3656	0.7031	2.4918
16.51	5.42	2.8040	1.6901	2.6474
17.69	17.7	2.8730	2.8736	2.8340
18.48	29.27	2.9167	3.3766	2.9133
19.12	43.55	2.9507	3.7739	2.9760
20.31	68.87	3.0111	4.2322	3.0482
22.35	110.28	3.1068	4.7030	3.1224
23.9	147.8	3.1739	4.9959	3.1686

Date : 10/30/2002

SUMMARY OUTPUT

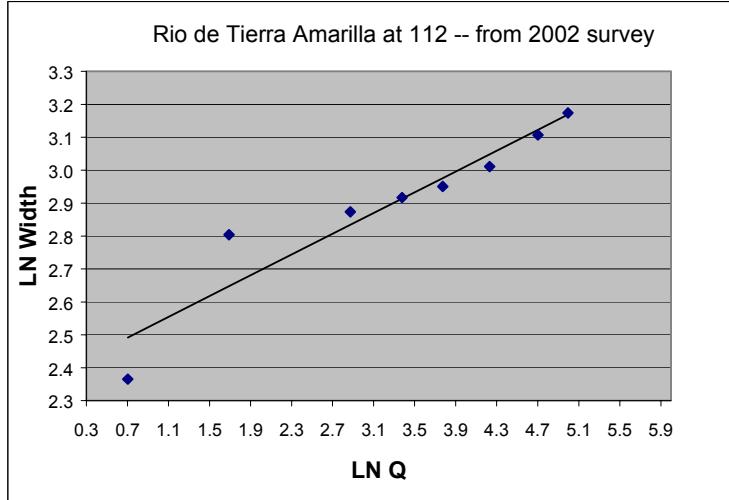
Regression Statistics	
Multiple R	0.94695354
R Square	0.896721007
Adjusted R Square	0.879507842
Standard Error	0.085888994
Observations	8

ANOVA

	df	SS	MS	F	Significance F
Regression	1	0.384301104	0.384301	52.095067	0.000358483
Residual	6	0.044261516	0.007377		
Total	7	0.42856262			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2.380968382	0.07808787	30.49089	8.259E-08	2.189894108	2.572043
X Variable 1	0.157657814	0.021843247	7.217691	0.0003585	0.104209274	0.211106

B term = X variable = 0.157657814
A term = e^ intercept = 10.8153712



Air temp corrections:

13.79 C	=air temp at Brazos@84 on 8/30/02'	=To	12.6 C	=air temp at Brazos@84 on 9/27/02'
7367 ft	=elevation at Brazos air station'	=Zo		
2245 m				
-0.00656 C/m	=Ct			

$$Ta = To + Ct * (Z-Zo)$$

	u/s	d/s	Z mid (ft)	Z mid (m)	Ta air temp (C)	Ta air temp (F)	30-Aug avg '71 - '00	August avg '71 - '00	
Chavez	10500	7570	9035	2754	10.45	50.81			
Brazos	7570	7367	7469	2276	13.58	56.45			
Chama	7620	7310	7465	2275	13.59	56.46	59	61.3	Chama, NM
RTA	8290	7150	7720	2353	13.08	55.55	62.6	65.3	El Vado Dam
Chama cal temp	7620	7310	7465	2275	12.40	54.32			

Relative humidity corrections:

using 30-year data from 1971-2000

Rh = Ro * [1.0640 ^ (To-Ta)] * [(Ta+273.16)/(To+273.16)]

57 %	=RH late Aug at Alamosa station	=Ro
15.6 C	=avr air temp late Aug at Alamosa	=To

	Ta air temp(C)	Rh RH corrected
Chavez	10.45	0.77
Brazos	13.58	0.64
Chama	13.59	0.64
RTA	13.08	0.66

4Q3 Derivations for ungaged Upper Chama streams

$$4Q3 \text{ ungaged} = 7.3287 \times 10^{-5} \times DA^{0.70} \times Pw^{3.58} \times S^{1.35}$$

Reference: USGS 2002

where

4Q3 = 4-day, 3-year, low flow frequency (cfs)

DA = drainage area (mi²)

Pw = average basin mean winter precipitation 1961-1990 (in)

S = average basin slope

Parameter	Brazos at Chama	Brazos at Chavez	Chavez at Brazos	RTA at Chama	RTA at HWY 64
Pw	20.9	20.67	15.92	13.57	14.93
DA	171	125	25.2	61.3	49.6
Slope	0.178	0.192	0.229	0.136	0.144
Elevation	10075	10010	9724	8412	8770
4Q3 (cfs)	13.88	11.86	1.93	1.00	1.31
4Q3 (mgd)	8.97	7.67	1.24	0.65	0.85

4Q3 derivations for portions of gaged Upper Chama streams

When ratio between the two watershed areas is between 0.5 and 1.5:

$$4Q3 \text{ ungaged} = Qt(u) = Qt(g) \times (Au/Ag)^{0.566}$$

Reference: USGS 1993

where

4Q3 = 4-day, 3-year, low flow frequency (cfs)

Qt(g) = 4Q3 at the gaged site (cfs)

Au = drainage area at the ungaged site (mi²)

Ag = drainage area at the gaged site (mi²)

Qt(u) = area weighted 4Q3 at the ungaged site (cfs)

When ratio between the two watershed areas is < 0.5 or > 1.5:

$$7Q2(u) = 1.36 \times 10^{-4} \times Au^{0.566} \times Pw^{3.32}$$

Reference: USGS 1970

7Q2 = 7-day, 2-year, low flow frequency (cfs)

Pw = average basin mean winter precipitation 1961-1990 (in)

$$4Q3(u) = 7Q2(u) \times [4Q3(g)/7Q2(g)]$$

$$4Q3(g) \text{ for Rio Chama at LaPuente gage based on Log Pearson Type III plot} =$$

17.5 cfs

$$7Q2(g) \text{ for Rio Chama at LaPuente gage based on Log Pearson Type III plot} =$$

22.0 cfs

Parameter	Chama at LaPuente (gage location)	Chama at Brazos (ungaged portion)	Chama at Little Willow (ungaged portion)
Ag	480		
Au		221	95
Au/Ag		0.46	0.20
Qt(u)		11.28	NA because outside of range
Pw			13
7Q2	22		8.94
4Q3(g)/7Q2(g)	0.80		
4Q3 (cfs)	17.5		7.11
4Q3 (mgd)		7.29	4.59